Corridor Cities Transitway Project

Economic and Tax Impact Analysis

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Executive Summary

The potential economic and tax impacts of two proposed transit modal alternatives for the Corridor Cities Transitway (CCT) project are discussed in this report. Below is a summary of the analysis context, assumptions, and results.

Context of the Analysis

The Maryland Transit Administration is currently studying various alternatives for the CCT, including different Bus Rapid Transit (BRT) and Light Rail Transit (LRT) alternatives. A locally preferred alternative (LPA) for the CCT has not been selected, and the implementation timeframe for the LPA will need to consider funding availability. The LRT alternatives are more expensive than similar BRT alternatives, so a longer implementation timeframe might be required to implement the CCT if LRT is selected as the LPA.[1] To illustrate the local economic and tax impacts of implementing the CCT sooner as BRT versus later as LRT, this analysis assumes the CCT could be implemented 10-12 years sooner as BRT than LRT. The analysis also includes local economic and tax impacts of the Life Sciences Center (LSC) development that is contingent upon CCT funding and implementation.

It is important to note that this analysis is limited in its scope and does not include several things. Namely, it is not a benefit-cost analysis, which is a more traditional measure of assessing whether the economic benefits of the CCT exceed the costs of the CCT. In addition, the analysis does not consider potential changes in property values associated with the operation of the CCT. Further, the analysis does not take into account the mobility and other user benefits induced during the operation of CCT. It also does not take into account tax impacts or jobs associated with operating the CCT transit service (see Table 1).

Table 1: Benefits Included in This Analysis

	Construction Phase			Operation Phase			
	Economic Impact	Employment	Tax Impact	Economic Impact	Employment	Tax Impact	Property Value Impact
BRT	X	X	X				
LRT	X	X	X				
LSC	X	X	X		X	X	

[1] A locally preferred alternative for the CCT has not been selected. The assumptions used in this analysis are illustrative and do not reflect official decisions about the scope, cost, or schedule of the CCT.

Analysis Assumptions

Below is an overview of the assumptions and methodology. Please refer to Chapter II for a more detailed description of the assumptions and methodology.

a) BRT total construction cost was assumed to be $491 million (in 2010 $), divided into two phases:
   - Phase 1 (from Shady Grove to Metropolitan Grove) construction begins in 2018 and ends in 2020. Total construction value is $319 million (in 2010 $).
   - Phase 2 (from Metropolitan Grove to Comsat) construction begins in 2026 and ends in 2028. Total construction value is $172 million (in 2010 $).

b) LRT total construction cost was assumed to be $772 million (in 2010 $), divided into two phases:
   - Phase 1 (from Shady Grove to Metropolitan Grove) construction begins in 2028 and ends in 2031. Total construction value is $483 million (in 2010 $).
   - Phase 2 (from Metropolitan Grove to Comsat) construction begins in 2038 and ends in 2040. Total construction value is $289 million (in 2010 $).

c) Construction phase economic [in terms of value added ($) and employment (person-years)] and tax ($) impacts were estimated using PRISM, an input-output multiplier based economic impact model. See Chapter II for a discussion on PRISM.

d) The estimated economic and tax impact results from 2014 to 2050 were discounted to present value using a 4% discount rate.

e) The construction of the Life Sciences Center (LSC) was assumed to be contingent on the construction of the CCT. Accordingly, for the BRT alternative, LSC construction was assumed to begin in 2014 and end in 2040; and for the LRT alternative, LSC construction was assumed to begin in 2024 and end in 2050.
   - LSC construction phase economic and tax impacts for the respective transit mode alternatives were estimated in the same manner as those of the BRT and LRT (see 'c' and 'd' above).
   - Based on estimates from the Montgomery County Planning Department, the LSC operation phase employment and tax impacts were estimated for the two LSC construction schedules described in 'e'.

f) BRT and LRT results include construction and operation phase benefits from the LSC project.

g) All costs used in the analysis are in 2010 dollars (i.e., not in year-of-expenditure dollars).

h) The study analysis period is from 2014 to 2050.

Analysis Results

These results combine BRT, LRT, and LSC construction phase benefits as well as LSC operation phase benefits. The BRT transit mode alternative yields higher economic, employment, and tax impacts during the course of the evaluation period (2014-2050), as illustrated in Figure 1, Figure 2 , and Figure 3. For example, the BRT transit mode alternative when compared with LRT yields 54%, 76%, and 74% more economic impacts, employment (in person-years), and tax impacts, respectively.

Figure 1: Present Value Economic Impact (value added, 2010 $ millions), 2014-2050

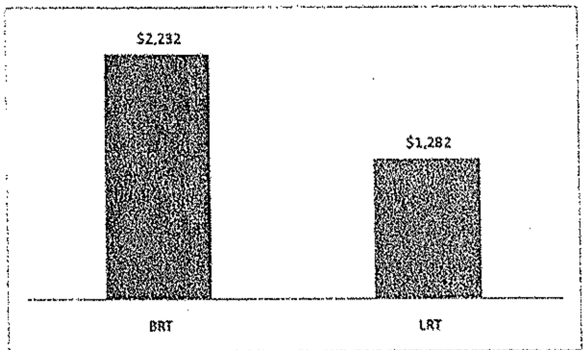


Figure 2: Employment (person-years), 2014-2050

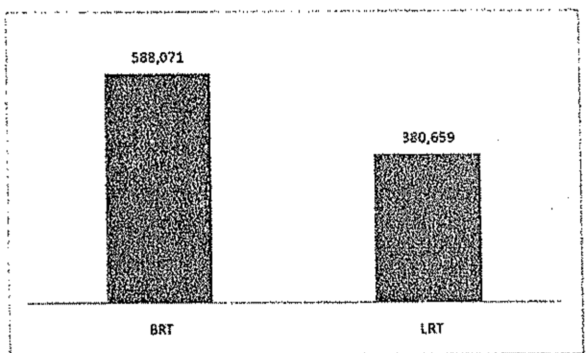
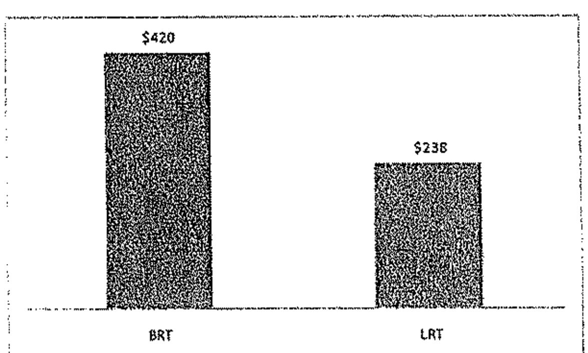


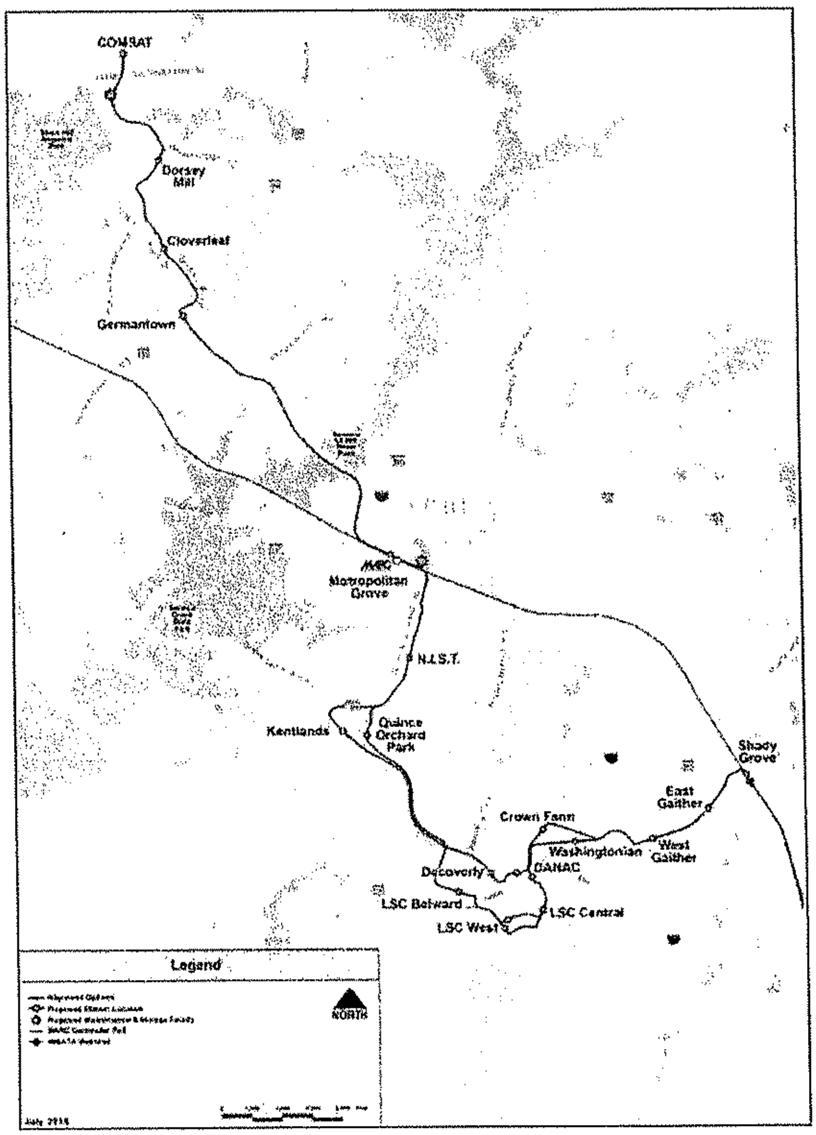
Figure 3: Present Value Tax Impact (2010 $ millions), 2014-2050



Chapter I: Introduction

Maryland Transit Administration is currently studying various alternatives for the CCT, including different Bus Rapid Transit (BRT) and Light Rail Transit (LRT) alternatives. While the LPA has not been selected yet, the proposed alignment for the CCT extends 15.3 miles from the Shady Grove Metrorail Station in the City of Rockville to COMSAT, a former satellite communications center north of Germantown (see Figure 4).

Figure 4: CCT Study Area Map



BRT refers to a system of modern articulated rubber tired rapid transit vehicles operating in a system similar in concept to light rail. Stations would offer advanced fare payment, multiple door boardings and alightings, real-time transit information on location and available on-line, and other similar premium transit service features. On the CCT, BRT would operate entirely on exclusive guideway; two curbed travel lanes separated from general purpose traffic, pedestrians and bicycles. Light rail on the CCT would be a double-tracked rail system. Vehicles are powered using electric centenary wires suspended from catenary poles located either to the side or between the tracks. Either system will be located either in the median or along the side of existing or planned roadways, depending on the location. Both systems would use advanced traffic management systems that will provide transit vehicle priority at appropriate intersections. Grade separation will be used at major intersections to avoid additional travel delay.

Development of the CCT will occur in two distinct phases as needed to facilitate the timely development of transit service where it is needed soonest, in the rapidly developing communities of Rockville and Gaithersburg. The first phase of the project will include the 8.9 mile segment from Shady Grove to Metropolitan Grove, the site of an extensive transit oriented mixed use residential and office complex as well as a transfer point with the MARC commuter rail service from Martinsburg West Virginia and Frederick, Maryland. Park and ride lots will be provided at numerous stations along the corridor. The second phase of the project will be from Metropolitan Grove to COMSAT, an area where development is anticipated and provided for in the County's master plan but for which the market has yet to mature.

The Maryland Transit Administration is in the final stages of completing travel forecasting analysis needed to inform a final decision on a LPA, a decision on mode and alignment. The purpose of this Economic Impact Study is to inform this decision with an analysis of the potential economic benefits and/or opportunity costs that may occur with the selection of one transit mode over another. The analysis is limited in scope and a number of facts and assumptions used to support this analysis are defined in the following pages.

Chapter II: Approach and Assumptions

Definitions

Value Added – is related to Gross State Product (GSP), which is equivalent, on a smaller scale, to Gross Domestic Product. It can be viewed as the local economy's GDP. It is the measure of the market value of all final goods and services produced in a specific geography. The primary components are: consumer spending, government spending, business investment, and net exports. It also can be defined as the total value of wages, net business income (including profits and retained earnings after taxes) and taxes paid by businesses to governments.

Person-years – for this employment estimate, a "job" is counting "person years." For example, 100 person-years may translate into 50 jobs supported for 2 years or 100 jobs supported for 1 year.

Tax – these impacts are based on applicable local and state taxes. (See Chapter IV, for more detail).

Direct/Indirect Impacts – Direct impacts represent new spending, hiring, and production by civil engineering construction companies to accommodate the demand for resources in order to complete the project. Indirect impacts result from the quantity of inter-industry purchases necessary to support the increase in production from the construction industry experiencing new demand for its goods and services. All industries that produce goods and services consumed by the construction industry will also increase production and, if necessary, hire new workers to meet the additional demand. The level of inter-industry trade within the area will determine the size of the indirect impact.

Induced Impacts – these impacts stem from the re-spending of wages earned by workers benefitting from the direct and indirect activity within area. For example, if an increase in demand leads to new employment and earnings in a set of industries, workers in these industries will spend some proportion of their increased earnings at local retail shops, restaurants, and other places of commerce, which would further stimulate economic activity.

Discounting – this incorporates the time value of money concept into the analysis. For example, let's assume an individual will receive $1,000 in one year's time. To determine the present value of this $1,000 (what is it worth for him/her today) the analysis would discount the $1000 by a particular rate of interest. Assuming a discount rate of 4%, $1,000 in a year's time would be equivalent of $961.54 to him/her today [(1000 / (1.00 + 0.04)].

Construction Schedules

BRT and LRT construction expenditure estimates were obtained from the CCT Capital Cost Estimate, Fourth Quarter 2010.

As illustrated in Table 2, with a total capital cost of $772 million, LRT would cost 57% more to construct than the BRT mode alternative. The capital costs included in this analysis excludes the following costs:

- ROW, land, existing improvements
- Vehicles
- Professional services

Costs that were excluded represent capital expenditures that would typically be expected to occur outside the study area, thus generating economic impacts outside Montgomery County, or represent land purchase costs which generally have negligible jobs and economic impacts. Phase I encompasses work done between Shady Grove and Metropolitan Grove, and Phase II Metropolitan Grove to the Comsat Center (see Table 2).

The timing of construction is based on assumptions made by project engineers/planners during the project planning phase for the CCT. While these schedules are purely illustrative and do not reflect specific planned implementation dates, they reflect an assumption that the higher cost of the LRT alternative would delay implementation to a later date because of the significant amount of funding required and the limited funding capacity of MDOT's Transportation Trust Fund. The percent spent by year in each phase was approximated and then applied to the construction expenditure totals for each phase based on the data from CCT Capital Cost Estimate, Fourth Quarter 2010 (see Table 2).

Table 2: Percent & Amount Spent by Year - BRT & LRT Transit Mode Alternatives

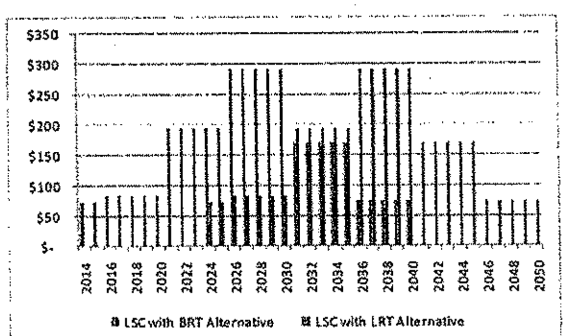
		BRT		LRT		
		Percent	2010$ millions		Percent	2010$ millions
Phase 1	2018	15%	$ 97	2028	10%	$ 96
	2019	20%	$ 129	2029	16%	$ 159
	2020	15%	$ 94	2030	17%	$ 160
				2031	7%	$ 68
Phase 2	2026	19%	$ 66	2038	21%	$ 121
	2027	19%	$ 66	2039	21%	$ 121
	2028	12%	$ 39	2040	8%	$ 47
Total		100%	$ 491		100%	$ 772

Life Sciences Center (LSC) construction expenditure estimate was obtained from the Montgomery County Planning Department. Given that the construction of the LSC was assumed to be contingent on the funding and construction of the CCT, PB developed an approximate construction schedule for the LSC with the BRT and LRT transportation mode alternatives based on growth forecasts provided by the Montgomery County Planning Department.

The development of the LSC construction schedule was informed by

- LSC residential and non-residential construction spending was projected to total approximately $4.2 billion[2] (Montgomery County Planning Department).
- Forecasted employment and households from 2005-2040 obtained from the Montgomery County Planning Department.
- The percent change in employment was applied to forecast non-residential spending and the percent change in households to residential spending, these spending estimated were then combined to yield forecasts for each of the five year intervals. The spending was spread evenly across each interval except the first, which was only divided across two years; this was done because construction of the LSC is not expected to begin until 2014 at the earliest.
- To assure consistency the respective construction schedules for BRT and LRT (Figure 5) were compared with the Great Seneca Science Corridor (GSSC) Master Plan[3]. The staging requirements as specified in the GSSC Master Plan include
    - Stage 1: Pre-planning, zoning, and health impact assessments. These requirements have already been met or in process; and as such this study assumed the earliest LSC construction spending to occur in 2014.
    - Stage 2: Fully fund construction of the CCT from Shady Grove to Metropolitan Grove (i.e., Phase I)
    - Stage 3: CCT is under construction from Shady Grove to Metropolitan Grove and at least 50% of construction funds have been spent.
    - Stage 4: Begin operating the CCT from Shady Grove to COMSAT (i.e. phase I and II).

Figure 5: LSC Spending Schedule with BRT and LRT Mode Alternatives, 2010$ millions



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[2] Source: Montgomery County Planning Department
[3] http://www.montgomeryplanning.org/community/gaithersburg/documents/GSSCStagingPresentationtoGSSCIAC3152011.pdf

BRT, LRT, LSC Construction Phase Methodology

Economic Impact (value added) and Employment

To calculate Value Added and Employment created by a project, using PRISM the following ratios were calculated using current state & county data (from IMPLAN):

$$\frac{Employment}{Output}, \frac{Value\ Added}{Output}$$

Where: Value Added = Employee Compensation + Proprietor Income + Indirect Business Tax.
Then using those ratios and the multipliers constructed by IMPLAN the following ratios are calculated at both the county and state levels:

$$\frac{Type\ I\ Multiplier}{\frac{Employment}{Output}}, \frac{Induced\ Multiplier}{\frac{Employment}{Output}},$$

$$\frac{Type\ I\ Multiplier}{\frac{Value\ Added}{Output}}, \frac{Induced\ Multiplier}{\frac{Value\ Added}{Output}}$$

These are the county and state level employment and value added multipliers that this analysis uses, the first is the direct & indirect multiplier and the second is the induced multiplier.

The Spillover Impacts, which result from induced spending/employment outside of Montgomery County but that remain within the state of Maryland, require similar ratios to be constructed (from IMPLAN):

$$\frac{Type\ SAM\ Multiplier}{\frac{Employment}{Output}}, \frac{Type\ SAM\ Multiplier}{\frac{Value\ Added}{Output}}$$

Then the county multiplier ratios are subtracted from these ratios:

$$\frac{Type\ SAM\ Multiplier}{\frac{Employment}{Output}} - \left(\frac{Type\ I\ Multiplier}{\frac{Employment}{Output}} + \frac{Induced\ Multiplier}{\frac{Employment}{Output}}\right),$$

$$\frac{Type\ SAM\ Multiplier}{\frac{Value\ Added}{Output}} - \left(\frac{Type\ I\ Multiplier}{\frac{Value\ Added}{Output}} + \frac{Induced\ Multiplier}{\frac{Value\ Added}{Output}}\right)$$

This yields the Employment and Value Added Spillover ratios used in this analysis the first is the direct & indirect multiplier and the second is the induced multiplier.

Then to calculate non-spillover county level employments the Direct & Indirect Employment ratios as well as the induced ratios are multiplied by the level of spending in the county then summed to yield the total county employment forecast in person years:

$$County\ Spending * \frac{Type\ I\ Multiplier}{\frac{Employment}{Output}} + County\ Spending * \frac{Induced\ Multiplier}{\frac{Employment}{Output}} = Total\ County\ Job\ Years$$

The same steps are repeated to calculate non-spillover county level value added but this time using the value added multipliers:

$$County\ Spending * \frac{Type\ I\ Multiplier}{\frac{Value\ Added}{Output}} + County\ Spending * \frac{Induced\ Multiplier}{\frac{Value\ Added}{Output}} = Total\ County\ Value\ Added$$

The same steps are repeated using State Level ratios and State level spending to calculate the Job Years and Value Added at the State level. To calculate the spillover effects, the spillover multipliers and the county level spending are used. Finally the Job Years and Value Added are summed; County + State + Spillover, producing final impact numbers for Job Years created and Value added. This final step is repeated for each year of the project with the county, and state spending varying according to the previously discussed spending schedule.

Tax Impacts

In calculating the Tax Impact of the Alternatives we started with the forecast Value Added for each one (by year).

'Value Added' (VA) can be broken into four components: Employee Compensation, Proprietor Income, Other Property Type Income, and Indirect Business Taxes, (EC, PI, OPI, IB) and it is from these four components that the Tax Impact is calculated. Estimating the Tax Impact requires several steps, first, using current data, the share each of the four components contributes to the region's pre-project 'Value Added' is calculated; this is done for each region and industry.

For example:

$$\%\ of\ Industry\ Y's\ VA\ attributed\ to\ EC = \frac{EC\ in\ County\ X\ and\ Industry\ Y}{Total\ VA\ in\ County\ X\ by\ Industry\ Y}$$

Next the calculated 'Value Added' of a project, broken down by Region and Industry, is retrieved and those values are multiplied by the 'share' each component of 'Value Added has been calculated to contribute to total 'Value Added'. This yields a breakdown of 'Value Added' by region, industry and component (e.g. Proprietor Income in Region X for Industry Y).

The next step sums these values over all the industries in a region yielding the breakdown of 'Total Value' into its four components for each region. Finally the regional 'Value Added' component subtotals are multiplied by the applicable tax rates both state and county level, then the results are summed to yield the total Tax Impact, this is done by year (for a list of included taxes see Appendix II).

Other Assumptions

The calculations in this analysis are also based on the following assumptions:

- The real discount rate of 4.0%
- Present Value calculated in the following manner

$$\sum_t \frac{Value\ Added_t}{(1+i)^t}$$

Where:
t – time period
i – discount rate
Value Added$_t$ – the Value Added in time period t

LSC Operation Phase Methodology

LSC operation phase employment and tax impacts were derived from a study done by Municap, Inc.[4] The fiscal impact projections done by Municap Inc., provided an estimate of total permanent jobs and annual gross revenues the Gaithersburg West Master Plan would generate. To establish estimated revenue created per job we divided annual gross revenue by total permanent jobs. This number was then applied to forecast employment levels to yield the estimated tax impact of the LSC during operation.

$$Tax\ Impact\ per\ Job\ Year = \frac{Annual\ Gross\ Revenue\ Forecast}{Annual\ Employment\ Forecast}$$

In this calculation we used the employment levels forecast by the Montgomery County Planning Department, treating each job created as permanent. This meant that a job created in 2025 counted as 26 job years by the end of the forecast period in 2050.

[4] Gaithersburg West Master Plan Montgomery County, Maryland; Executive Summary Fiscal Impact Projections Scenario A; Prepared by: Municap Inc.; October 21, 2009

Chapter III: Results

Economic Impacts (value added)Table 3 shows the present value economic impact (i.e., value added) by mode alternative. Columns 1 and 2 show economic impact by year for the BRT and LRT, respectively then columns 3 and 4 show the 'value added' for the LSC on its own, built in combination with the BRT and LRT. The last two columns combine the economic impact of LRT and BRT with the LSC to yield the projects total present value economic impact by year. As shown in the last row, the present value of BRT in combination with LSC is \$2.2 billion and the present value of the economic impacts of LRT in combination with LSC is \$1.3 billion.

The estimated economic impact is heavily dependent on the amount of spending forecast for each alternative; this would suggest that the LRT and LSC combination should yield the greatest economic impact. However, once the results are translated into present value the BRT and LSC combination yields a higher economic impact. So while spending for the LRT is \$281 million greater (in 2010 \$ terms) than the BRT, the BRT and LSC combinations present value economic impact is \$950 million greater (in 2010 \$ terms), which is 74% more than the LRT and LSC combination.

Table 3: Study Area Economic Impacts (Present Value) – BRT, LRT, and LSC (Construction Phase Value Added), 2010 \$ Millions

Year	BRT	LRT	LSC with BRT	LSC with LRT	Total BRT	Total LRT
2014			\$ 55		\$ 55	
2015			\$ 53		\$ 53	
2016			\$ 59		\$ 59	
2017			\$ 57		\$ 57	
2018	\$ 63		\$ 55		\$ 117	
2019	\$ 80		\$ 53		\$ 133	
2020	\$ 56		\$ 51		\$ 106	
2021			\$ 112		\$ 112	
2022			\$ 108		\$ 108	
2023			\$ 104		\$ 104	
2024			\$ 100	\$ 37	\$ 100	\$ 37
2025			\$ 96	\$ 36	\$ 96	\$ 36
2026	\$ 31		\$ 138	\$ 40	\$ 169	\$ 40
2027	\$ 30		\$ 132	\$ 38	\$ 162	\$ 38
2028	\$ 17	\$ 42	\$ 127	\$ 37	\$ 144	\$ 79
2029		\$ 67	\$ 122	\$ 35	\$ 122	\$ 103
2030		\$ 64	\$ 118	\$ 34	\$ 118	\$ 99
2031		\$ 27	\$ 66	\$ 8	\$ 66	\$ 34
2032			\$ 64	\$ 7	\$ 64	\$ 7
2033			\$ 61	\$ 7	\$ 61	\$ 7
2034			\$ 59	\$ 7	\$ 59	\$ 7
2035			\$ 56	\$ 6	\$ 56	\$ 6
2036			\$ 24	\$ 93	\$ 24	\$ 93
2037			\$ 23	\$ 89	\$ 23	\$ 89
2038		\$ 36	\$ 22	\$ 86	\$ 22	\$ 122
2039		\$ 34	\$ 21	\$ 83	\$ 21	\$ 117
2040		\$ 13	\$ 20	\$ 79	\$ 20	\$ 92
2041				\$ 45		\$ 45
2042				\$ 43		\$ 43
2043				\$ 41		\$ 41
2044				\$ 40		\$ 40
2045				\$ 38		\$ 38
2046				\$ 15		\$ 15
2047				\$ 14		\$ 14
2048				\$ 14		\$ 14
2049				\$ 13		\$ 13
2050				\$ 13		\$ 13
Total	\$ 277	\$ 283	\$ 1,955	\$ 999	\$ 2,232	\$ 1,282

Employment Impacts

Table 4 shows the employment (in person-years) created by the construction of each alternative. Columns 1 and 2 show present person-years by year for the BRT and LRT, respectively, then columns 3 and 4 show person-years supported by the LSC during its construction and operation phases. The last two columns combine person-years created by BRT and LRT with the LSC to yield the total person-years added. The total row shows the total job years created by the construction. The total person-year jobs created by BRT with LSC (which is approximately 588,000) is 54% higher than the person-year jobs created by the LRT and LSC combination. Similar to economic impact, employment created in the construction phase of a project is largely dependent on its spending level. However, since the BRT with LSC is scheduled to be completed 10 years before the LRT with LSC, the BRT alternative creates more jobs (person-years) by 2050 (i.e., LSC operations, under the BRT alternative will have been supporting employment for 10 years longer than the LRT with LSC.

Table 4: Total Employment – BRT (construction phase), LRT (construction phase), and LSC (construction and operation phases), person-years

Year	BRT (construction phase)	LRT (construction phase)	LSC with BRT (construction and operation phase)	LSC with LRT (construction and operation phase)	Total BRT	Total LRT
2014			$ 1,560		$ 1,560	
2015			$ 2,147		$ 2,147	
2016			$ 2,957		$ 2,957	
2017			$ 3,614		$ 3,614	
2018	$ 1,290		$ 4,270		$ 5,560	
2019	$ 1,719		$ 4,927		$ 6,646	
2020	$ 1,246		$ 5,584		$ 6,830	
2021			$ 8,168		$ 8,168	
2022			$ 9,275		$ 9,275	
2023			$ 10,383		$ 10,383	
2024			$ 11,490	$ 1,560	$ 11,490	$ 1,560
2025			$ 12,598	$ 2,147	$ 12,598	$ 2,147
2026	$ 884		$ 15,049	$ 2,957	$ 15,933	$ 2,957
2027	$ 884		$ 16,222	$ 3,614	$ 17,106	$ 3,614
2028	$ 520	$ 1,276	$ 17,394	$ 4,270	$ 17,914	$ 5,546
2029		$ 2,127	$ 18,567	$ 4,927	$ 18,567	$ 7,054
2030		$ 2,127	$ 19,740	$ 5,584	$ 19,740	$ 7,711
2031		$ 912	$ 18,768	$ 8,168	$ 18,768	$ 9,080
2032			$ 19,408	$ 9,275	$ 19,408	$ 9,275
2033			$ 20,047	$ 10,383	$ 20,047	$ 10,383
2034			$ 20,687	$ 11,490	$ 20,687	$ 11,490
2035			$ 21,327	$ 12,598	$ 21,327	$ 12,598
2036			$ 20,414	$ 15,049	$ 20,414	$ 15,049
2037			$ 20,826	$ 16,222	$ 20,826	$ 16,222
2038		$ 1,616	$ 21,237	$ 17,394	$ 21,237	$ 19,010
2039		$ 1,616	$ 21,649	$ 18,567	$ 21,649	$ 20,183
2040		$ 617	$ 22,060	$ 19,740	$ 22,060	$ 20,357
2041			$ 21,116	$ 18,768	$ 21,116	$ 18,768
2042			$ 21,116	$ 19,408	$ 21,116	$ 19,408
2043			$ 21,116	$ 20,047	$ 21,116	$ 20,047
2044			$ 21,116	$ 20,687	$ 21,116	$ 20,687
2045			$ 21,116	$ 21,327	$ 21,116	$ 21,327
2046			$ 21,116	$ 20,414	$ 21,116	$ 20,414
2047			$ 21,116	$ 20,826	$ 21,116	$ 20,826
2048			$ 21,116	$ 21,237	$ 21,116	$ 21,237
2049			$ 21,116	$ 21,649	$ 21,116	$ 21,649
2050			$ 21,116	$ 22,060	$ 21,116	$ 22,060
Total	$ 6,543	$ 10,291	$ 581,528	$ 370,368	$ 588,071	$ 380,659

Tax Impacts

The tax impact of each alternative is a function of not only how much is spent and when but also by the number of jobs it creates. Table 5 shows the present value of the tax impacts for BRT and LRT. Columns 1 and 2 show the tax impact for the BRT and LRT, respectively. Columns 3 and 4 show the tax impact of the LSC during construction and operation phases. Last two columns combine the tax impact of the BRT and LRT with the LSC to yield the combined tax impact. As shown in the last row, the present value tax impact of the BRT with LSC combination is $420 million, which is 76% higher than the tax impact of the LRT with LSC combination.

Table 5: Total Tax Impact – BRT, LRT, and LSC (2010$ Millions)

Year	BRT (construction phase)	LRT (construction phase)	LSC with BRT (construction and operation phase)	LSC with LRT (construction and operation phase)	Total BRT	Total LRT
2014	$ -	$ -	$ 4	$ -	$ 4	$ -
2015	$ -	$ -	$ 5	$ -	$ 5	$ -
2016	$ -	$ -	$ 6	$ -	$ 6	$ -
2017	$ -	$ -	$ 6	$ -	$ 6	$ -
2018	$ 4	$ -	$ 7	$ -	$ 11	$ -
2019	$ 5	$ -	$ 7	$ -	$ 13	$ -
2020	$ 4	$ -	$ 8	$ -	$ 11	$ -
2021	$ -	$ -	$ 13	$ -	$ 13	$ -
2022	$ -	$ -	$ 13	$ -	$ 13	$ -
2023	$ -	$ -	$ 14	$ -	$ 14	$ -
2024	$ -	$ -	$ 14	$ 3	$ 14	$ 3
2025	$ -	$ -	$ 14	$ 3	$ 14	$ 3
2026	$ 2	$ -	$ 18	$ 4	$ 20	$ 4
2027	$ 2	$ -	$ 18	$ 4	$ 20	$ 4
2028	$ 1	$ 3	$ 18	$ 5	$ 19	$ 7
2029	$ -	$ 4	$ 18	$ 5	$ 18	$ 9
2030	$ -	$ 4	$ 18	$ 5	$ 18	$ 9
2031	$ -	$ 2	$ 15	$ 9	$ 15	$ 10
2032	$ -	$ -	$ 15	$ 9	$ 15	$ 9
2033	$ -	$ -	$ 14	$ 9	$ 14	$ 9
2034	$ -	$ -	$ 14	$ 9	$ 14	$ 9
2035	$ -	$ -	$ 14	$ 10	$ 14	$ 10
2036	$ -	$ -	$ 12	$ 12	$ 12	$ 12
2037	$ -	$ -	$ 11	$ 12	$ 11	$ 12
2038	$ -	$ 2	$ 11	$ 12	$ 11	$ 15
2039	$ -	$ 2	$ 11	$ 12	$ 11	$ 15
2040	$ -	$ 1	$ 11	$ 12	$ 11	$ 13
2041	$ -	$ -	$ 9	$ 10	$ 9	$ 10
2042	$ -	$ -	$ 9	$ 10	$ 9	$ 10
2043	$ -	$ -	$ 8	$ 10	$ 8	$ 10
2044	$ -	$ -	$ 8	$ 10	$ 8	$ 10
2045	$ -	$ -	$ 8	$ 9	$ 8	$ 9
2046	$ -	$ -	$ 7	$ 7	$ 7	$ 7
2047	$ -	$ -	$ 7	$ 7	$ 7	$ 7
2048	$ -	$ -	$ 6	$ 7	$ 6	$ 7
2049	$ -	$ -	$ 6	$ 7	$ 6	$ 7
2050	$ -	$ -	$ 6	$ 7	$ 6	$ 7
Total	$ 19	$ 19	$ 401	$ 219	$ 420	$ 238

Summary Results

Although LRT is estimated to cost more than the BRT, because of construction timing the BRT and LSC combination has the largest impact across all three measures, as shown in Table 6.

- The BRT with LSC combination yields a present value $2.2 billion in terms 'value added/economic impact' which is $950 million or 74% more than LRT with LSC.
- In terms of employment, BRT with LSC is estimated to create approximately 200,000 more jobs (in person-years) than the LRT with LSC, which is an increase of 55% from the 380,000 supported by the LRT with LSC.
- The present value tax impact of BRT with LSC is $416 million, which is 75% more than the LRT with LSC at $238 million.

Table 6 Summary Table, Economic and Tax Impacts, 2014-2050

	Value Added	Employment	Tax Impact
	2010 $ millions	person-years	2010 $ millions
BRT with LSC	**2,232**	**588,071**	**416**
BRT (Construction Phase)	277	6,543	19
LSC (Construction Phase)	1,995	56,046	127
LSC (Operation Phase)	-	525,482	270
LRT with LSC	**1,282**	**380,659**	**238**
LRT (Construction Phase)	283	10,291	19
LSC (Construction Phase)	999	56,046	88
LSC (Operation Phase)	-	314,322	131

Sensitivity Results

- Sensitivity test I: the present value analysis for value added and tax impact were performed using a 1% real discount rate instead of the 4% assumption. Using the 1% real discount rate assumption, the BRT with LSC option still had larger present value economic benefit, i.e., value added and tax impacts were higher than the LRT with LSC option by 28% and 40%, respectively.

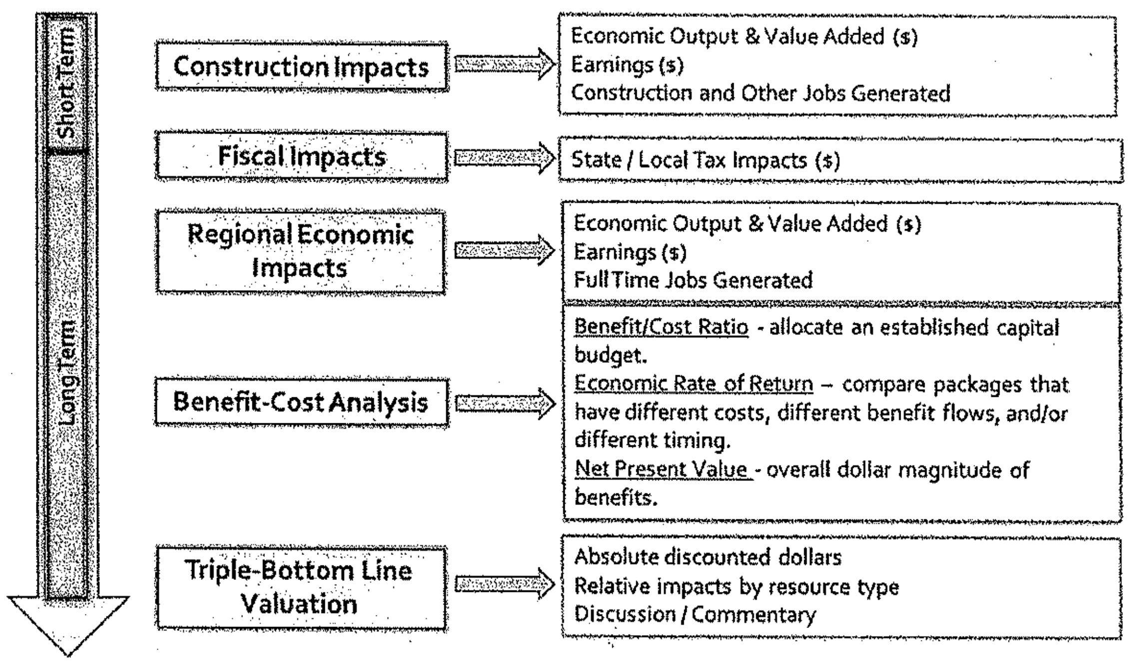
- Sensitivity test II: tax and employment impacts were calculated for LRT using a longer analysis period, 2014-2060 (as opposed to the baseline assumption of 2014-2050). When compared with BRT (whose analysis period remained at the baseline assumption of 2014-2050), LRT (with LSC) had 1% higher person-year jobs, and 32% lower tax impacts.

Chapter IV: PRISM

PB's proprietary economic analysis tool, PRISM, is a web-based application that is designed as an easy-to-use, flexible, and transparent model that can allow agents in both the public and private sectors to better accomplish the following:

- Create long-term strategic capital plans that highlight viable future transportation infrastructure projects.
- Rank or prioritize a set of planned infrastructure project alternatives in the short- or medium-term, depending on the desired outcomes of the client (e.g. the expected rate of return, environmental benefits, new jobs created, or economic output).
- Determine the economic feasibility or economic impact of current, planned, or potential transportation projects at the local, county, regional, or state levels.

PRISM's modular structure is graphically illustrated in the exhibit below.



Of the five modules illustrated above, the Construction Impact Module, which is uses an input-output modeling framework was used for the Maryland CCT analysis.

An Input Output Model (IO Model) is a comprehensive mathematical representation of the flows of goods and services among all the industry sectors which comprise an area's economy, including households which collectively (i.e., as a "sector") provide labor services and spend money for purchases of goods and services. Input Output models were pioneered by the economist Wassily Leontief in the late 1930s, for which he eventually received the Nobel Prize in Economics in 1973. IO Models are a standard tool in economics, and the U.S. Census Department's Bureau of Economic Analysis maintains a

U.S. National Input Output Model, published as part of the National Income and Product Accounts statistics. IO models are periodically updated to reflected changes in industry practices, production technologies, and changes in the mix of products and services which comprise a changing economy at any given time.

While the mathematics and details of IO models can be involved, the models are built on "Inter-industry Transactions" tables (or matrices) which show the flow of sales of products from one sector (outputs) to corresponding purchasing industries (inputs). For example, farmers may sell $1 million in farm products to local food industries, which process the foodstuffs and package them for sale to consumers. In this case, the $1 million represents an output of the agricultural industry, and also an input to the food processing industry. In turn, those finished food products can be sold to retailers, who sell it to households. These final sales represent, in the language of IO models, "final demand".

Using matrix algebra, the inter-industry transactions tables can be used to derive "multipliers", which show how increased final demand for outputs of a given sector will recycle through the entire economy, to produce a total impact (on output, employment, and wages) that is greater than the initial round of new spending. Typically, multipliers for output are in the range of 1.5 to 2.5 – that is, the total impact on all sales of goods and services in an area can be 1.5 to 2.5 times the original "first round" increase. For example, if demand for the manufacturing of shoes increases in an area by $100 dollars, the total amount of spending, including sales of leather goods, strings for shoelaces, polish, legal services, and payments to workers, would increase by $150 to $250 dollars.

The 'Construction Impacts module' uses, multipliers from MIG Inc. who are the developers of IMPLAN. Using IMPLAN, we customize the 'Construction Impacts module' for any county requested, based on information related to the actual structure of the region's economy, including the actual extent to which particular industries are present in an area. – for most regions, which do not make every product that might be used to produce something within its borders, those products must be brought in from the outside, and thus would have a smaller impact on the local economy than might be the case at the national level. For this analysis multiplier specific to Montgomery County and the state of Maryland were employed.

The IMPLAN multipliers are used to estimate the total impacts on a region's economy by multiplying the project spending by them, to obtain total economic impacts.

In addition, PRISM applies the following taxes to the corresponding portion of value added: Corporate Profits Tax; Dividends; Indirect Business Tax; Personal Tax; and Social Insurance Tax.

County Executive Correspondence	
ID: 674-12 CE	TO: Dept. of Transportation Art Holmes, Director
TODAY'S DATE: 11/10/2011	FROM: Pat Siok, Coordinator, 7-2507
DUE DATE:	INSTRUCTIONS Handle As Appropriate cc: Tom Street